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ABSTRACT

This document discusses identification and control of the pests of trees and shrubs. The insects are grouped according to feeding habits and the type of damage caused to plants. Categories include the sucking insects and mites, leaf eating insects, pests attacking trunks and branches, and gall causing insects. (CS)

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Insects & Related Pests of Trees, Shrubs, & Lawns

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COLLEGE OF AGRICULTURE
AGRICULTURAL EXTENSION SERVICE
UNIVERSITY OF WYOMING—LARAMIE
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INSECTS AND RELATED PESTS OF

TREES, SHRUBS, AND LAWNS

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INSECT AND RELATED PESTS OF TREES, SHRUBS, AND LAWNS

A. Introduction

Almost every ornamental tree, shrub, or flower growing in Wyoming is subject to attack by insects or mites and may need protection. Some trees and shrubs require a number of years to become established for adding beauty to the home grounds. Damage to their growth and appearance must be held to a minimum whenever possible, especially since replacement is costly and sometimes impossible.

The many insects and mites of ornamentals have different habits, are active at different times of the growing season, cause different types of injury, and may require a specific host for their development. Successful insect and mite control depends upon recognition of common pests and understanding their habits so that a recommended and timely control measure can be initiated before serious damage occurs.

Proper cultural and management practices are important in avoiding or reducing pest damage to ornamental plants. Consider these measures in management: proper and adequate watering, careful pruning, necessary fertilizing, and use of plant materials adapted to your area. Plant troubles resulting from malnutrition, winter injury, drought and heat injury, smoke, gas and mechanical injury are often mistaken for damage from insect or disease attack. All such factors should be taken into consideration when diagnosing a problem in the absence of an insect or mite specimen.

A control treatment, following each pest description is given by formulas listed at the end of this publication. When possible several different controls are given for each pest to enable a greater choice of suitable chemicals.

The Extension Service (County Agricultural Agents and Extension Entomologist) will gladly assist, insofar as they are able, with diagnosing insect or mite problems and with recommendations for their control.

The pests of trees and shrubs described in this publication are grouped according to their mouthparts and feeding habits and the type of damage to the plants. The groups included are the sucking insects and mites, which feed on various plant juices by piercing the plant tissue; leaf eating insects, which have chewing mouthparts; pests attacking trunks and branches; and those insects and mites which cause various odd-shaped formations on plants known as galls. The mouthparts of some insects do not always indicate the kind of damage they do, such as gall makers, borers, and leaf miners.

B. General Plant Feeders

1. Ants (Figure 1.)

Ants are often annoying and sometimes destructive in flower gardens and in the lawn. Several species of ants may build nests among the roots of plants causing the plants to die from root exposure to air. They may also destroy seeds or prevent good stands in seeded lawns. Ants often harbor aphids from which they obtain honeydew; the aphids in turn suck sap from various flowers and ornamental shrubs.

Control

Locate ant nests and treat. If a general area is infested thoroughly treat the entire area.

Formula A or C. Specific chemical controls; see pp. 44-46.

2. Centipedes (Figure 2.)

Centipedes are normally outdoor creatures that feed upon insects and other small animals. They do not injure plants or house furnishings. They run rapidly, having one pair of strong legs on each body segment. They prefer damp situations and are found mostly under stones, dead leaves, old boards, about grass roots, and rubbish piles. Their bodies are relatively long in proportion to their width and are greatly flattened. This shape and their many body segments give them a ribbon-like appearance. The flattened body makes it possible for centipedes to squeeze into cracks and crevices, from which they sometimes penetrate to wall spaces of houses and find their way thence into living and sleeping rooms. They conceal themselves in shoes, in folds of clothing, behind pillows, in beds, and in other darkened places. Centipedes would be of little concern to man if it were not for their habit of coming into houses.

Centipedes are feared by many because they have poison glands in the claws of the first pair of leglike appendages. The poison injected into insects and other tiny creatures when they are bitten by a centipede usually causes immediate death or paralysis, thus aiding the centipede in capturing its prey. Most centipedes throughout the North are comparatively small and rarely, if ever, enter houses or bite man. Any one of the larger southern centipedes can inflict a painful bite if it is pinched or handled. There seems to be no record of a centipede seriously harming persons in this country, although secondary infection may result from the bite. Centipedes are not welcome in or around houses, even though they feed upon insects and may truthfully be considered beneficial.

Control

Apply one of the formulas around the foundations and other damp areas where they are found.

Formula A or C. Specific chemical controls; see pp. 44-46.

3. Millipedes (Figure 3.)

Millipedes, like centipedes, are normally outdoor creatures. They are not carnivorous, but feed upon decaying vegetable matter in damp soil and on decaying wood, and often eat the tender roots of plants and even green leaves that touch the ground. A few are pests of cultivated crops. Millipedes are slow-crawling creatures with rounded many-jointed bodies. They have two pairs of very short legs on each body segment after the first three, which have only one pair each. If touched when crawling, they curl up.

At certain times millipedes become restless and leave the soil and crawl into houses, sometimes swarming over basements and the first-floor rooms. Millipedes are most troublesome during the fall of the year, when hordes may crawl into areaways, into cellars, up foundation walls, through small openings, and into various rooms. They may crawl up side walls and drop from ceilings. More often they are confined to the basement and to the floors of rooms over unexcavated soil. The fall migrations are possibly concerned with a natural urge to seek hibernation quarters. Heavy rains may raise the water level in the soil, force the millipedes out of their natural abode, and send them in search of shelter elsewhere. In cottages in wooded areas, or in newly developed areas with virgin soil still filled with decaying vegetation, as many as 700 millipedes may enter a room during a single evening.

Millipedes shun the sun, are most abundant on the shaded side of a house, crawl during the evening, and hide during the daytime in the soil, or beneath stones and boards, or in other darkened places. They prefer dampness. Dryness destroys them. Millipedes do not bite persons, do not harm house furnishings, and do not eat sound wood. But a large population of millipedes usually disrupts the contentment of the home and calls for remedial measures.

Control

Apply one of the formulas around foundations and other damp areas where they are found. Try to eliminate hiding places.

Formula A or C Specific chemical controls; see pp. 44-46

4. Grasshoppers (Figure 4.)

Grasshoppers are a problem every year in many parts of Wyoming. Unless they are controlled, damage to ornamentals and the vegetable garden can be great in most seasons.

Grasshoppers lay eggs in the soil during July, August, and September. Their preferred egg laying areas are roadsides, weed patches, ditch banks, and fence rows. The eggs overwinter and hatch in late May and June. There is one generation each year. Drought conditions often reduce natural vegetation and force the hoppers from weed infested areas into lawns and home gardens.

Control

Control measures are most successful when applications are made while the hoppers are small to infested areas along the edge of the yard, ditch banks, or roadsides.

Treat infested plants and surrounding areas.
Formula: A, B, C or J. Specific chemical controls; see pp. 44-46.

5. European Earwig (Figure 5.)

The European earwig adult is reddish brown and about 3/4 of an inch long. Unlike most insects, it has a pair of forceps on the rear end. The eggs are laid in small batches in a chamber 2-3 inches below the soil surface. The young usually mature in one season and most have one generation per year. Earwigs are primarily scavengers on dead insects and rotted plant material; some feed on living plants and often become pests of the household and vegetable garden. They damage sweetcorn by feeding on the silk.

They are active at night; during the day they find shelter beneath boards, stones, sidewalks, or trash.

Control

The earwig is an outdoor insect. Control can usually be accomplished by applications of an insecticide outdoors since this is where the problem originates. Such measures may be enhanced by removing the cover under which they are hiding.

Treat infested plants and surrounding areas.
Formula: A or C. Specific chemical controls; see pp. 44-46.

6. Sowbugs and Pillbugs (Figure 6.)

Sowbugs and pillbugs are found throughout Wyoming, and feed primarily on decaying or green plants. They sometimes wander indoors where they do no damage; such an invasion usually signifies a heavy population of these pests in the immediate area outside the home. They often get into damp basements and crawl spaces.

Sowbugs are flat, oval, or slightly elongated, up to 1/2 inch in length; grayish (slate-gray) in color and are wingless. Their body segments are easily visible and appear as armored plates. The sowbug has two tail-like appendages and cannot roll into a tight ball like a pillbug. Pillbugs are similar except they lack the tail-like appendages, and can roll up into a tight ball at the least disturbance. From this action the nickname "pillbug" is derived.

The sowbugs and pillbugs are crustaceans and are more like shrimp and crayfish than insects. They have a high moisture requirement, and are inhabitants of dark, damp places such as under trash, grass clippings, boards, and rocks. They are relatively slow moving creatures.

Control

Controls can be at least partially accomplished by removal of hiding places, moist areas, and food materials. Areas around buildings may also be thoroughly treated.

Formula: A, B or C. Specific chemical controls; see pp. 44-46.

C. Pests of Trees, Shrubs and Flowers

1. Sucking Insects

Figure 1. Ant

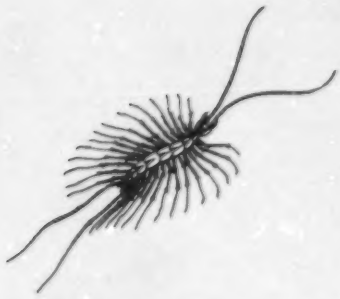

Figure 2. Centipede

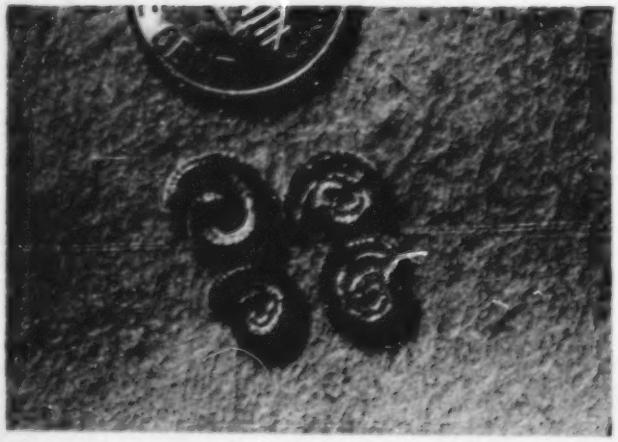

Figure 3. Millipede

Figure 4. Grasshopper

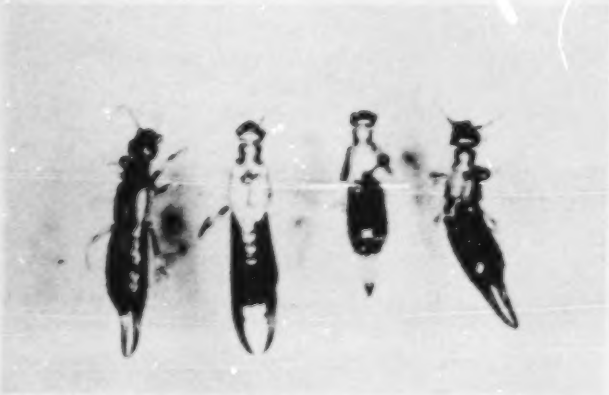

Figure 5. European Earwig

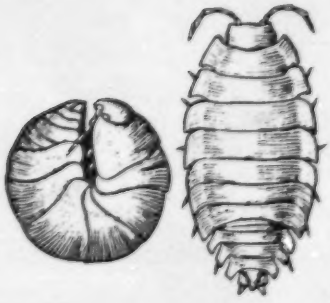

Figure 6. Pillbug and Sowbug

a. Elm Leaf Aphid (Figure 7.)

Pale yellow or pinkish aphids feed on the undersides of leaves. They are most annoying of all the aphids found on elm trees. Their liquid excrement called "honeydew" contains sugar and is sticky. Often it is so plentiful that it falls as a mist from trees and covers objects with a sticky film. In moist weather a fungus called "sooty mold" often develops on honeydew and causes branches and leaves to have a sooty appearance. This fungus does not infect leaves but appears on honeydew of many aphids and scale insects. Ants also feed on honeydew and are often associated with aphids.

Control

Formula: A, C, I, J, or L. Specific chemical controls; pp. 44-46.

b. Rose Aphid (Figure 7.)

This and other species of 1/8 inch long green or pink plant lice are often found sucking sap from stems beneath flowers and buds. The rose aphid overwinters in the egg stage on rose stems.

Control

Formula: A, C, I, J, or L. Specific chemical controls; pp. 44-46.

c. Spirea Aphid (Figure 7.)

Tips of growing shoots of spirea in some years become heavily infested with these green, 1/8 inch long aphids. Other aphid species may also attack spirea, but this one is the most common.

Control

Formula: A, C, I, J, or L. Specific chemical controls; pp. 44-46.

d. Woolly Apple Aphid (Figure 7.)

Woolly apple aphids and woolly elm aphids are similar. Both are purple bodied and are covered with a white, woolly wax. Infestations arise from overwintering eggs on elms. Aphids hatch early in spring and migrate to terminal buds. Annually, the first three generations are spent on elms and the last three on other hosts.

Woolly apple aphids feed on young leaves near the ends of branches in spring. They may feed at the base of buds and cause them to open prematurely. Their feeding causes leaves to become distorted and to cluster or bunch together. Therefore, this aphid is sometimes called the "leaf cluster" aphid or the "rosette" aphid. Large numbers are often found in the deformations. They also infest mountain ash as well as roots of apple trees.

Control

Formula: A, C, I, J, or L. Specific chemical controls; pp. 44-46.

e. Woolly Elm Aphid (Figure 8.)

Similar to the woolly apple aphid in appearance, the woolly elm aphid, which hatches from overwintering eggs on elms, causes single elm leaves to become curled or rolled along one edge in a gall-like manner. Curled leaves are deserted by the aphids in July, but they may persist on twigs well into the winter.

Control

Formula: A, C, I, J, or L. Specific chemical controls; pp. 44-46.

f. Woolly Elm Bark Aphid

This is a brown-bodied aphid with a white, woolly, waxlike covering. Apparently this aphid spends its entire life on elm where it feeds by sucking sap from branches and twigs. Enlarged or knotty growths on twigs and branches are a result of its feeding.

Control

Formula: A, C, I, J, or L. Specific chemical controls; pp. 44-46.

g. Boxelder Bugs (Figure 9.)

Boxelder bugs pass the winter in the adult stage in such protected places as houses and other buildings, stone walls, tree holes, and large accumulations of debris. On warm winter days they appear on sunny sheltered places, particularly on white or light-painted surfaces. In spring, when buds open, the bugs leave their winter quarters and seek host trees, preferably boxelder or ash, on which to feed and lay eggs. In warm climates there appear to be two generations a year.

When weather turns cold in the fall, adult bugs and large nymphs cluster and seek suitable hibernation quarters for the winter. During the time of migration, the bugs occasionally become annoying and disgusting household pests as they crawl or fly about. Boxelder bugs are plant feeders, and therefore do not feed on structures, household furnishings, or food products. When hibernating indoors, the bugs may stain curtains, papers, and similar objects with fecal spots.

Full-grown boxelder bugs are about 1/2 inch long and resemble common squash bugs. The reddish body is marked with broad, shaded areas of brown on the lower surface. The thorax has three longitudinal red lines, one down the center, and one on each side. There are also red markings on the front wings. Other parts of the body are dark brown. The young boxelder bugs are bright red. These insects are true bugs with sucking mouthparts.

Control

If only a few trees on your property attract boxelder bugs, and if these trees have no particular value, consider

removing them, particularly the female or pod-bearing trees. Remember, however, that the bugs can move from other boxelder or ash trees in your neighborhood. Wholesale cutting of boxelder trees is not recommended.

Insecticides are more effective when used directly on the young bugs. Thoroughly treat the infestation with considerable pressure.

Formula: A, B, D, H, or L. Specific chemical controls; pp. 44-46.

h. Leafhoppers (Figure 10.)

Although these insects are capable of extensive foliar injury if present in heavy concentrations, their major importance lies in their ability to transmit plant diseases.

There are several species of leafhoppers which feed on ash. There is hardly a tree or shrub which is immune from the attacks of one or more species of leafhoppers. The injury is characterized by white stippling of the leaves followed by yellowing and eventually browning. They are quite slender and generally quite small, rarely exceeding 1/4 inch in length. The immature forms resemble the adults and can easily be spotted by their peculiar habit of running sideways. Coloration varies but green seems to be predominate, making both the nymphs and adults difficult to see.

Control

Formula: B, C, D, J, K or L, M. Specific chemical controls; pp. 44-46.

i. Cottony Maple Scale (Figure 11.)

Silver maple trees may be weakened by periodic epidemic infestations of this scale. Many other trees and shrubs such as willow, poplar, boxelder, honey locust, hackberry and elm are also attacked. Infestation is evidenced by the presence of white cottony masses on undersides of small branches. Leaves may yellow, become sooty with mold, and sometimes drop off prematurely. Viewed closely, each brown scale with its white egg mass somewhat resembles a kernel of partially popped corn, about 1/4 inch across.

Eggs hatch in late June or July; the crawlers migrate principally to the undersides of the leaves where they suck out juices. In the fall, the partially-grown scales migrate back to twigs where they overwinter. Adults suck sap from twigs and branches before laying white egg masses in late spring.

Control

Apply an insecticide when the crawlers are out and repeat in 10 days.

Formula: A, B, C, or J. Specific chemical controls; pp. 44-46.

j. European Elm Scale

European elm scales are easily seen on the bark of elm trees during early summer when the scales reach maturity. The

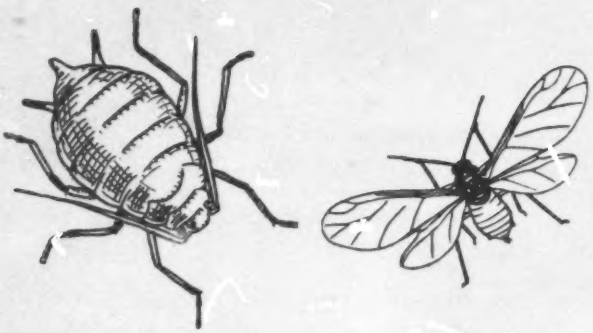

Figure 7. Aphids

Figure 8. Elm leaves curled by wooley elm aphid.

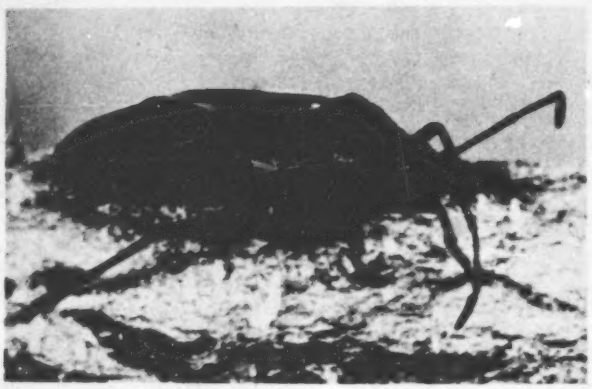

Figure 9. Boxelder bug

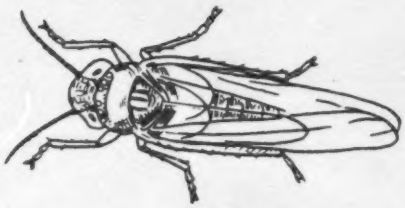

Figure 10. Leafhopper

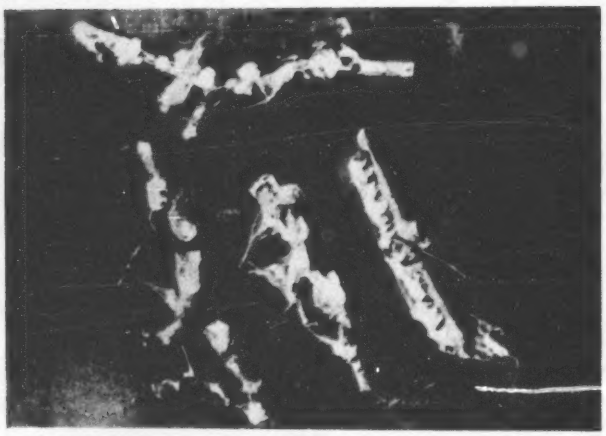

Figure 11. Cottony maple scale

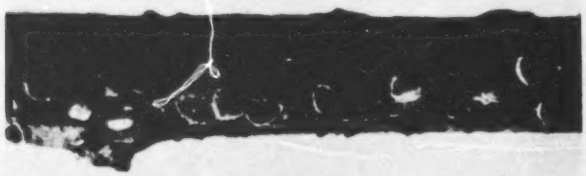

Figure 12. European elm scale

scales are oval, not over 1/16 of an inch long, reddish purple, and surrounded by a fringe of white, waxy secretion. They are commonly found on the undersides of limbs and branches. When crushed with the finger, they leave a reddish stain.

The European elm scale is common in Wyoming wherever American elms are grown. It also has been seen on Chinese elms in the state. When abundant, it is a serious and destructive pest. Found in the United States for about 75 years, it is most injurious to city plantings.

Scales attack lower branches of trees first and if not controlled they will infest the entire tree. Scales damage trees by sucking sap from the leaves and tender branches. Elms suffering from European elm scale have a dark, sooty-colored bark caused by a fungus that grows on the sticky honeydew that the scales secrete.

Infested elm trees display a yellowing of the leaves on lower branches during July. Later in the season, seriously infested branches may become yellowish-brown. When scales are extremely abundant, the foliage turns gray-green and wilts.

European elm scale insects pass through a single generation each year. Insects pass the winter in cracks and crevices of the bark as half-grown scales embedded in masses of cottony wax. In spring they move out and begin feeding along lower sides of branches and larger limbs.

Upon maturing, females mate with either wingless or winged males, attach themselves permanently to the host plant, and begin laying eggs. Late in June, crawlers appear from under mature female scales and migrate to leaves, where they remain throughout the summer. The old females produce new crawlers for about a month before dying. In fall, before the leaves drop, the half-grown scales return to the branches and larger limbs to spend the winter.

Control

Apply an insecticide when crawlers are out and repeat in 10 days.

Formula: A, B, C, or J. Specific chemical controls; pp. 44-46.

k. Lecanium Scale (Figure 13.)

The adult female scale, up to 1/8 inch in diameter, is almost hemispherical, smooth, and of a shiny-brown color. Both the adult and nymph stages of this insect injure plants by sucking sap.

The winter is passed in a partially grown condition on the twigs and branches of previous year's growth. The scale

reaches maturity in April and May; eggs are laid and continue to hatch from mid to late July. The young vary in color from yellow to pale brown. The scales are often crowded together so closely on twigs and branches that they overlap and migrate from the twigs to the leaves.

Control

Apply an insecticide when the crawlers are moving to the leaves or treat any time after the eggs have hatched (July 15-Aug. 1).

Formula: A, B, C, or J. Specific chemical controls; pp. 44-46.

1. Oyster Shell Scale (Figure 14.)

Oyster shell scales are large insects, easily detected with the naked eye. They derive their name from a hard, waxy protective covering secreted by their bodies. The scale, covering the insect as a shield, resembles a miniature oyster shell. It is brownish-gray with concentric bands, broadly rounded at one end, and about 1/8 inch long and 1/16 inch wide.

Oyster shell scale infests many kinds of shade trees, shrubs, and perennial plants. It is probably the insect pest most destructive to lilacs and ash in Wyoming. Other host plants include ash, poplar, willow, elm, maple, and cotoneaster.

Scales often are so abundant on lilac bushes, ash trees, and cotoneaster shrubs that they form a complete crust on the bark.

Insects puncture the bark with their mouthparts and suck the plant juices. Badly infested branches weaken and die. These tiny scale insects kill whole lilac bushes and ash and willow trees.

Each female lays 50 to 60 oval, off-white eggs under the old scale before dying. The winter is passed in the egg stage. Overwintering eggs usually hatch in late June or early July into yellowish-white, mite-like crawlers. Barely visible to the naked eye, they crawl over the host plant for a few hours, insert their thread-like stylets into the bark, and begin sucking sap. After feeding starts, they grow rapidly and secrete a wax-like material which forms the scales. Females remain under the scales for the rest of their lives. One generation a year is produced in Wyoming.

Control

Treat with an insecticide at the time the eggs are hatching (June 10-30) and the crawlers are moving out from under the parent scale towards new growth. Repeat the treatment in 10-14 days.

Formula: A, B, C, or J. Specific chemical controls; pp. 44-46.

m. Pine Needle Scale (Figure 15.)

Both male and female pine needle scales have white and elongate shields with a yellow spot near one end. Their shapes vary with the shape and width of the needles on which the insects occur. Female scales may be from 1/8 inch to 1/16 inch long; they vary from pear shape on spruce needles to linear shape on pine needles. Males are always straightsided and measure only 1/25 inch long.

Pine needle scales infest pine, spruce, and fir. Spruce is especially hard hit in Wyoming.

This pest seldom kills the tree. It causes needles to fall and trees to become weakened and discolored and to appear unhealthy. Injury comes when thousands of scales suck great amounts of sap from the needles.

Before dying each female lays 20 to 30 very small, purple-red eggs under the old scale. Winter is passed in the egg stage. Overwintering eggs usually hatch in late June or early July, depending upon the weather and locality. Eggs hatch into dark red, mite-like crawlers that creep over the needles for a short time. Young scales (crawlers) soon insert their stylets into the needles and remain in the same location.

Scales seem to prefer the undersides of needles on the lower parts and within the protected portions of the tree. In such locations they can occur in large numbers and may not be noticed.

Control

To determine the best time to apply control measure, examine the infested trees for crawlers every 3 or 4 days during late June and early July. Scrape some of the scales off onto a white piece of paper or remove one of the scales with a needle. With a magnifying glass notice if the eggs have hatched. If, by this examination, you find they are hatching, apply the recommended insecticide.

Control often is difficult, largely because of failure to obtain thorough coverage. If application is made after insects are shielded with their waxy, protective covering, control is difficult also. Since the crawlers move around on the tree, apply the spray to all parts of the trunk, twigs, and needles.

Treat with an insecticide when the crawlers are out and then repeat the application in 10-14 days.

Formula: A, B, C, D, J, or L. Specific chemical controls; pp. 44-46.

n. Scurfy Scale (Figure 16.)

This grayish-white, pear-shaped, 1/8 in. long scale is

usually found on the bark of its host plant. The plants most commonly attacked are cottonwood, willow, apple, pear, mountain ash, redosier dogwood, black-raspberry, currants, and other deciduous trees and bush plants. Withdrawal of sap by an infestation of this scale reduces the vitality of the plant, kills branches and limbs, and sometimes, if the plant is young, deforms it.

The mature female scales are about 1/8 inch long, but the mature males are only about 1/4 as long as the females.

The insect passes the winter as purplish-red eggs beneath the shell of the dead females. The eggs hatch in mid-May. The females complete their growth, lay their eggs, and die in August or September. The males die soon after mating. There is one generation a year in Wyoming.

Control

Treat with an insecticide when eggs hatch and the crawlers are out.

Formula: A, B, C, or J. Specific chemical controls; pp. 44-46.

o. Spider Mites (Figure 17.)

Red spiders or spider mites attack a wide variety of plants. There are a number of distinct mite species; but since all are very similar in appearance, habits, injury, and control, they may be treated as a group.

The pest is a small mite, barely visible to the naked eye. Its color varies from light yellow to pink, red, green, or brown. The eggs are straw colored and are usually laid on the undersides of the leaves. Most of the mites overwinter as adult females in plant refuse near a host plant. In spring they migrate to the leaves of the host plant where eggs are laid. Red spiders thrive in hot, dry weather and usually become most abundant during July and August. They injure the host plant by sucking juices from the leaves. The spiders live largely on the undersides of leaves and in other protected places. Plants badly infested with red spider mites turn yellow and take on a sickly appearance.

Control

Chemical controls consist of spraying from July to August. The trees should be thoroughly covered and the spraying repeated in 10 days if necessary. A forceful spray of cold water repeated several times will dislodge the mites and help control them on ornamental trees.

Apply treatment as soon as first signs of mite damage appears. The best way to check for mites is to hold a sheet of white paper under a branch and tap the branch sharply with a stick. If mites are present they will fall and then can be

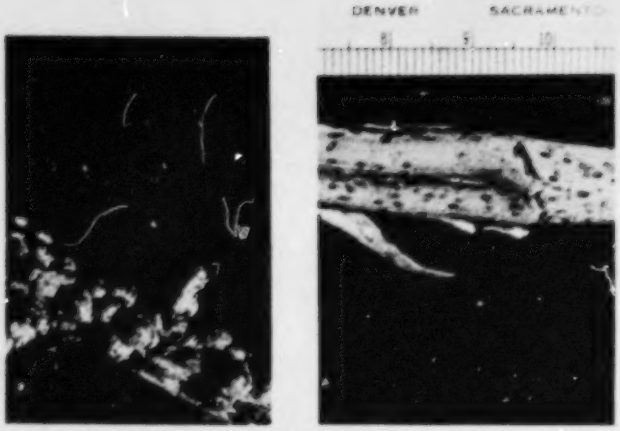

Figure 13. Lecanium scale adults left, crawlers right

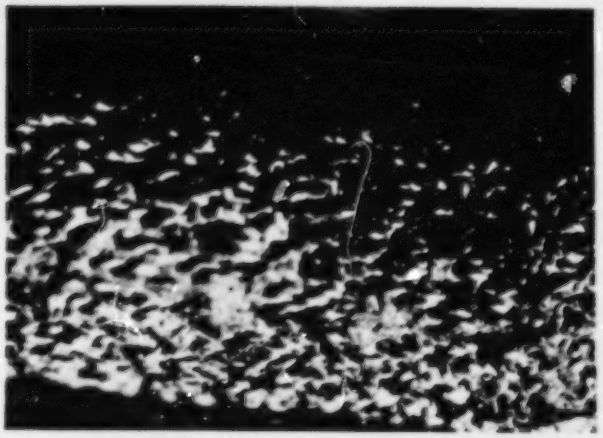

Figure 14. Oyster shell scale

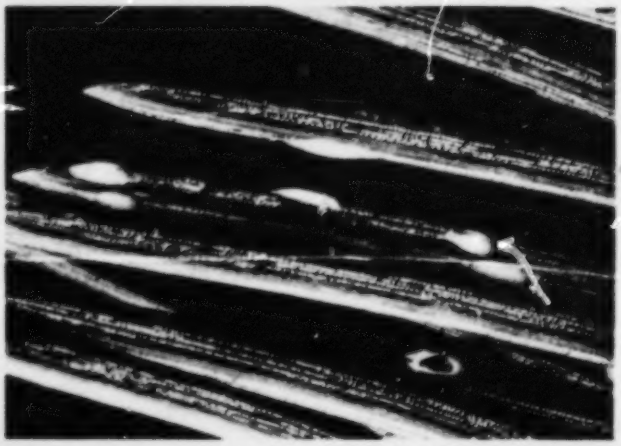

Figure 15. Pine needle scale

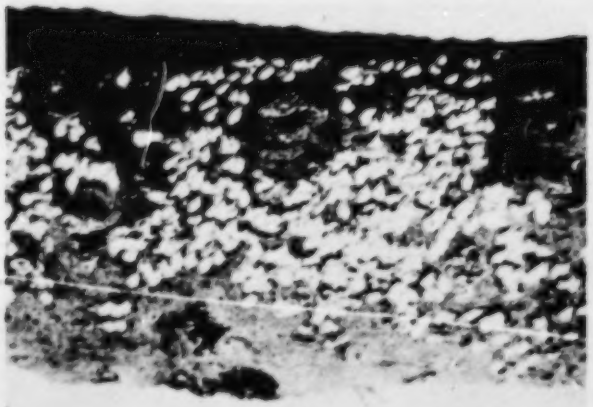

Figure 16. Scurfy scale

Figure 17. Spider mite

Figure 18. Thrips

seen crawling over the paper.
Formula: C, J, O, or P. Specific chemical control; pp. 44-46.

p. Spittlebugs

Spittlebugs have often been found on juniper in Wyoming. The nymphal or immature stages are spent in frothy masses of spittle on their host plant. The nymphs feed by sucking juices from the plant. The spittle is excreted by the nymphs and whipped into a froth by contraction of the abdomen. The froth serves as a means of protection from dessication and predators. They overwinter as eggs which hatch during May and complete their growth in July. The adults are brownish jumping insects about 3/8 inch long.

Control

Light infestations can be controlled by pruning off the twigs containing the spittle.
Formula: A, C, I, J, K, L, or T. Specific chemical controls; pp. 44-46.

q. Whiteflies

Whiteflies are usually not a problem to the outdoor gardner in Wyoming; however, they may be found on a variety of ornamentals. When whiteflies are present, they fly about like snowflakes when the foliage is disturbed. The immature stages resemble small scale insects attached to the underside of the leaves. The whiteflies are tiny, the nymphs or immatures are oval flat and pale green. They are a sucking insect.

Control
Formula: C, J, or L. Specific chemical controls; pp. 44-46.

r. Thrips (Figure 18.)

Although very small in size, thrips do quite a bit of damage because they are so abundant. Most of the thrips are about 1/16 inch in length. The color varies from a light yellow to a nearly black. They have four long and narrow wings and have a fringe of hair on the borders, giving them the appearance of small feathers. Most of the economically important species lay their eggs in the plant tissue. Both the young and the adults feed by rasping the leaf surfaces and sucking up the exuding juices. The injury causes distortion of plant parts in many instances, especially where the thrips feed in the buds. Infestation of flower buds often results in malformed and spotted flowers.

Control
Formula: C, D, I, J, L, or T. Specific chemical controls; see pp. 44-46.

2. Chewing Insects

a. Blister Beetle (Figure 19.)

This discussion is given for the blister beetle group rather than for any specific species.

Only adults feed on foliage, but they are often ravenous and may stunt or kill the plants be devouring most of the foliage.

Damage is done principally to shrubs and flowering plants are also attacked and damaged.

The color varies, depending on species. They may be black, brownish, gray, or shiny metallic blue to green. Their general shape is that shown by the illustration. The size of various species ranges from less that 1/2 inch in length to over one inch. Usually the width is about 1/4 the length. Winged species travel in droves, they are strong fliers, and may descend on a garden or field and in a very short time do considerable damage. The adults have chewing mouthparts, two pair of wings, and may fly or walk when moving from place to place.

Most of the females lay their eggs in clusters of 100, more or less, in holes that they make in the soil. The eggs are yellow, cylindrical, and elongate.

The newly hatched larvae are very active and strong jawed, and burrow through the soil until they find an egg mass of a grasshopper upon which to feed and complete their development.

The yellowish-orange colored pupae are often found in the partially destroyed or destroyed grasshopper egg mass on which they have developed.

Control

Apply a spray as soon as beetles are noticed.
Formula: A, B, or J. Specific chemical controls; see pp. 44-46.

b. Spring and Fall Cankerworms (Figure 20.)

The larvae of both species of cankerworm are about 1 inch long when mature and are commonly called measuringworms or inchworms. While they feed on leaves of several hosts, elm is the principal host and extensive defoliation often occurs from May to June. Larvae begin feeding on new leaves and eat all but the main veins. Cankerworms probably cause more elm defoliation than any other insect. Defoliated trees grow new leaves and are rarely, if ever, killed but may be weakened.

Adult males are winged moths, but females are wingless, and after females emerge from the soil, they crawl up tree trunks and lay eggs on twigs and branches. Fall cankerworm adults emerge in fall but spring cankerworms emerge in early

spring. However, eggs laid by both species hatch in early spring and their larvae feed simultaneously.

Control

Control is the same for both species. Sticky bands placed so that they encircle the trunks will trap the females as they crawl upwards. Bands should be applied in early September and renewed in early spring.

Apply a spray early in the spring when the larvae are small.

Formula: A, B, or K. Specific chemical controls; see pp. 44-46.

c. The Codling Moth

The codling moth, a pest of apples, has been included in this publication on tree and shrub because the apple tree is used as an ornamental in many parts of Wyoming. Also, if the apples are to be harvested control measures are suggested.

The codling moth is the most important pest of apples in Wyoming. It feeds on apple, pear, and crab apple.

The larva eats its way into the center of the apple and feeds on the seeds and core. Later it tunnels back out and leaves the fruit. It most often enters through the calyx end. Sometimes, it enters where two fruits touch or where a leaf touches a fruit.

Female codling moths lay their eggs singly on the foiliage or fruit. The egg is pearly white and oval in shape. The newly hatched larva is semi-transparent, white with a shiny black head and about 1/16 inch long. When mature, it is pinkish white with a brown head and about 3/4 inch long. The full-grown larva spins a silken cocoon under bark or other suitable shelter. The pupa is about 1/2 inch long and varies in color from yellow to brown, depending on age.

Adult moths are variable in size, with a wing expanse of 3/4 inch or less. The wings are brownish gray with dark bands. Near the tip of each forewing, there is a brown spot which contains two irregular coppery-colored lines.

Codling moths overwinter as mature larvae in waterproof cocoons under the bark or in the ground at the base of the tree. In May or June, they change into light brown pupae. This stage may last 4 to 6 weeks.

Moths of the spring brood reach a peak of activity during June in most localities. Temperatures influence the extent of egg-laying and the development of first-generation larvae (worms), and are important in determining seasonal codling moth activity. However, larval injury depends mostly upon

the initial infestation. The greater the population of overwintering larvae available to produce egg-laying females, the greater the chances for early fruit damage.

Eggs of the first generation usually take 12 to 14 days to hatch because of cool weather. First-generation larvae enter the fruit over a period of 5 to 6 weeks. The pupal period lasts from 10 days to 2 weeks, and first-generation moths appear by midsummer and may be present until cool weather.

Eggs of the second generation hatch after 6 to 7 days. Second-generation caterpillars appear in mid-to late summer, depending on locality, and attack the fruit for about 6 weeks. Second-generation caterpillars leave the fruit and go into winter quarters during August and September.

Control

Apply a spray about 7-10 days after the petals fall, repeat 3 or 4 applications every 10-14 days.

Formula: A, C, or K. Specific chemical controls; see pp. 44-46.

d. Cottonwood Leaf Beetle (Figures 21 & 22.)

Severe damage may be caused to cottonwood, poplar and willow trees by the cottonwood leaf beetle. The larvae completely destroy all of the leaves excepting the fine network of veins; often large areas of leaves are completely defoliated. The adult is 7 to 9mm long, metallic dark-purple or blackish with broad lateral orange markings on the prothorax, and has yellowish outer wings usually with seven purplish spots on each one. There are many variations in the color pattern of adults.

Control

Formula: A, B, or K. Specific chemical controls; see pp. 44-46.

e. Elm Leaf Beetle (Figure 23.)

The elm leaf beetle is one of the most destructive pests of Chinese elm in Wyoming. Although all species of elm are subject to attack, the beetles prefer the Chinese elm. Both the beetles and the larvae feed on the underside of the leaves. Foliage of entire trees is often skeletonized.

The adult, or beetle, is about 1/4 inch long, yellowish to olive-green, with dark green to black strips along the margin of each wing cover. The antennae are long and yellow. In the spring the adults come out of hibernation, fly to nearby trees, and begin chewing holes in the new developing leaves. Female beetles deposit clusters of elongate, yellow eggs on the underside of the leaf during late May and early June. The eggs hatch in about a week and the larvae feed approxi-

mately three to four weeks. The young larvae appear nearly black, when full-grown are approximately 1/2 inch long, dull yellow with two black stripes down the back. They then crawl down the tree in search of a place to pupate. Some will pupate under the rough bark on the trees, on the soil and in the grass at the base of the tree.

Pupation lasts from one to two weeks. The entire life cycle from egg to adult may last from thirty to forty five days, with two generations per year in Wyoming. The second generation usually occurs in mid-August to early September.

The beetles start seeking hibernation quarters late in August continuing until cold weather.

Control

Control measures should be applied when the beetles first appear in the first generation. One thorough and properly timed spray application may give protection throughout the season. If neighboring trees are not treated, it may be necessary to repeat the treatment and observe the tree for damage from the second generation.

Apply a spray for the first generation along in late May to the early part of June or treat for the 2nd generation larvae which starts to show about Aug. 10 to Aug. 20.

Formula: A, B, or K. Specific chemical controls; see pp. 44-46.

f. Garden Slug

Slugs cause problems throughout the United States. They damage plantings in ornamental and vegetable gardens and greenhouses.

These pests are frequently abundant in gardens, causing damage by attacks on seedlings, flowers, shrubs, and vegetables. In greenhouses, slugs assault the young seedlings and the more succulent parts of plants. They annoy home owners through their presence in cellars, around foundations, on walks, and in window wells.

Common slugs found in gardens are small, soft-bodies, grayish or mottled, slimy creatures averaging about 3/4 inch in length, rarely more than 1 1/2 inches.

Slugs feed on molds, decaying organic matter, and on the foliage of plants. They must have a large amount of moisture to survive, and they prefer darkness. Mainly nocturnal, they come out of their hiding places to feed in the evening or on dark days. Favorite hiding places are under old decaying boards and logs, in rock piles, and beneath any damp refuse such as leaves and materials under plants. Window wells and

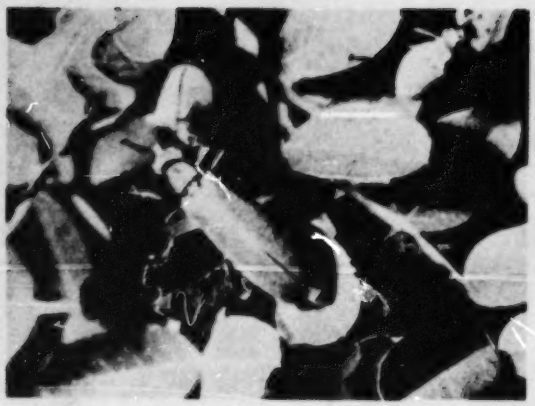

Figure 19. Blister beetle
U.S.D.A. Photograph

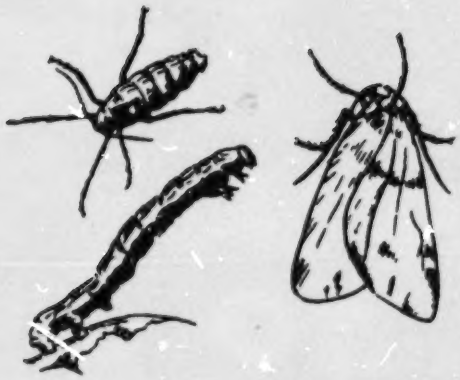

Figure 20. Fall cankerworm

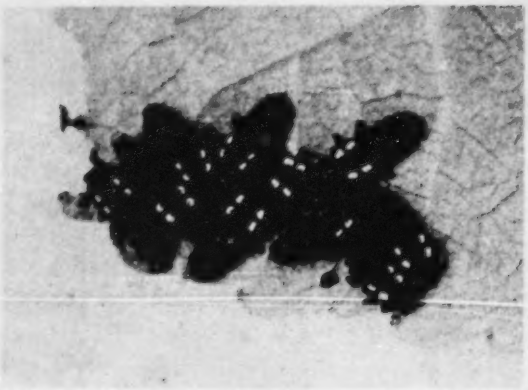

Figure 21. Cottonwood leaf beetle larva

Figure 22. Cottonwood leaf beetle adult
U.S.D.A. Photograph

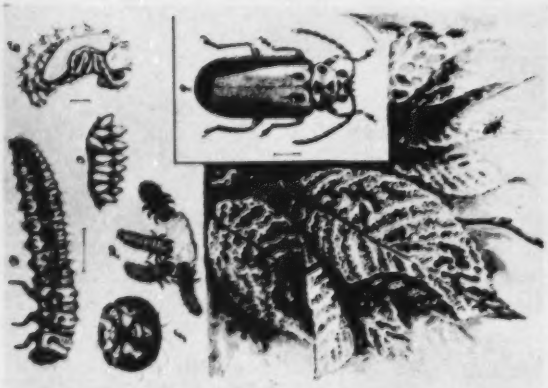

Figure 23. Elm leaf beetle
adult, larvae and damage
U.S.D.A. Photograph

damp basements harbor many of these pests.

Slugs leave a silver-colored, slimy trail wherever they travel. These trails can be seen on foundation walls, basement floors, walks, and plant leaves.

Control

Slugs are controlled by eliminating their preferred hiding places. Remove rotting boards and debris left on the ground or stored in the basement. Keep crawl space under the house free of trash. In greenhouses, many slugs will hide under rotting boards, flower pots, and debris beneath benches.

Most garden supply centers have a slug and snail bait which should be applied according to directions on the label of the package. Apply to the soil surface around plants. Do not apply bait to edible plant parts.

Slugs become paralyzed and usually die when exposed to the sun. However, on cool, moist days some may recover, necessitating repeated application of the pesticide.

Since slugs are nocturnal in the habits, apply bait late in the afternoon or at night. Apply it when the ground is moist or wet as the pests are more active on soil surface then. If possible, do not use the bait just before rain as effectiveness may be reduced.

Slugs may feed intermittently rather than every day. For these reasons, distribute fresh bait at intervals of 7 to 10 days.

Formula: Q or K. Specific chemical controls; see pp. 44-46.

g. Leafcutter Bees (Figure 24.)

The damage caused by the leafcutter bees frequently attract attention by the circular areas which they cut from the leaves. Rose foliage is most often used for this purpose, although the leaves of honeysuckle and ash are also cut. These pieces of leaves are used in forming a thimblelike cup or cell for the young. Cells or nests are made in the pruned or broken ends of branches or in the pithy stems. As the larva hollow out the pith of living plants the injured portion is killed. These leaf-cutter bees are of medium size, usually black, brown, metallic green, or bluish.

The cutting of leaves is usually not extensive enough to cause serious injury to the plant.

Control

No insecticide registered for this use.

h. Leaf Miner (Figures 25 & 26.)

Blistering and browning of the leaves of cottonwood

during late June and July are caused by the feeding of a leaf miner. The larvae overwinter within cells in the upper layers of soil beneath trees and pupate in May. The black adult sawflies emerge from cells in May, fly to foliage, and deposit eggs within the leaf tissue. In 7 to 10 days, whitish larvae can be seen feeding in small, blistered, translucent spots in the leaves. They feed for a month, constantly enlarging their mines until a large portion or the entire leaf is damaged. When mature, the larvae drop to the ground and pupate. The second brood of adults appears in late July, but causes less damage than the first, since they lay eggs only in the newly developing leaves on the sucker growth and tops of the trees. There are 2-3 generations each year.

Control

Apply a spray when the mines first start to appear.

Formula: A, C, D, J, or L. Specific chemical controls; see pp. 44-46.

i. Lilac Leaf Miner (Figure 27.)

The lilac leaf miner has become a serious threat to lilac plantings in many communities throughout Wyoming. The minute larvae enter the leaf and feed upon the soft tissue causing leaves to appear as if they had been burned. Upon completing the feeding cycle, the larvae curl the leaves about them and pupate. The adult female moth is approximately 3/8 inch long and lays her eggs on the lilac leaves in the early spring. Generally in Wyoming there are two or three generations; the first damage usually occurs in late June or early July, with another generation in early August and sometimes another in September.

Control

To control the insect it is important that lilacs be sprayed during mid June followed by two or three successive applications 10-14 days apart when necessary.

Apply a spray when the mines first start to appear.

Formula: C, D, J. or L. Specific chemical controls; see pp. 44-46.

j. Leaf Roller (Figure 28.)

The fruit tree leaf roller has many hosts which include many fruit and shade trees such as apple, ash, cotoneaster, elm, oak, maple, Russian Olive, and poplar. The adult is pale yellow to orange red and has a wingspread of 18-25mm. The forewings are mottled with golden scales. The hindwings are fuscous and have dirty white fringes. Full grown larvae are light green and about 20-25mm long.

Adults are present from June to August depending on the geographical location. Eggs are deposited in small round or convex masses containing about 100 to 150 eggs each, usually on twigs or small branches. Winter is spent in the egg stage and hatching occurs in early spring. Young larvae feed on

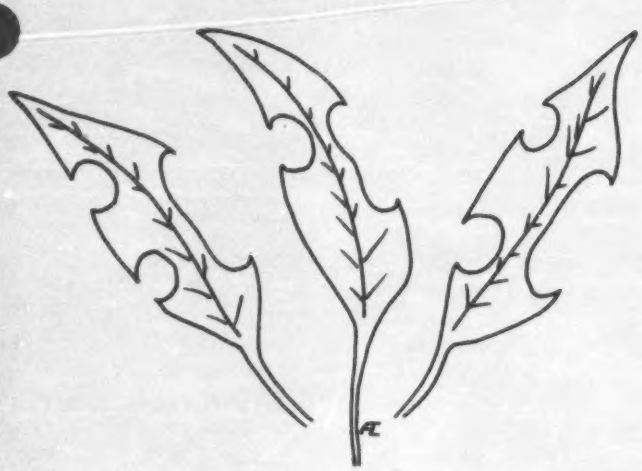

Figure 24. Leafcutter bee damage

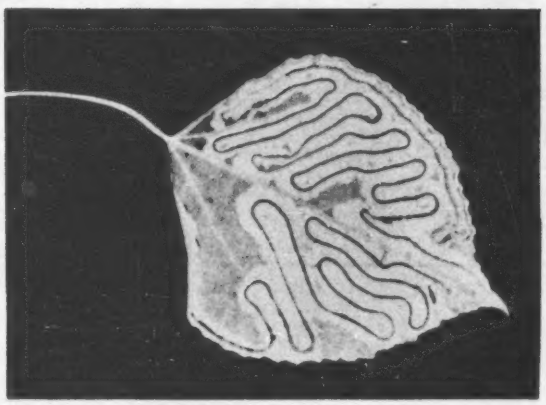

Figure 25. Leaf miner damage to aspen
U.S.D.A. Photograph

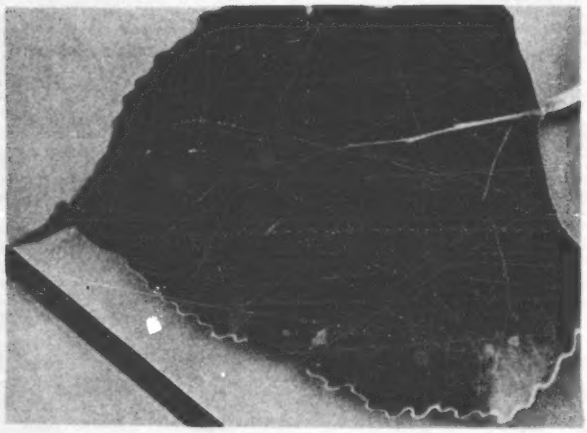

Figure 26. Leaf miner on cottonwood

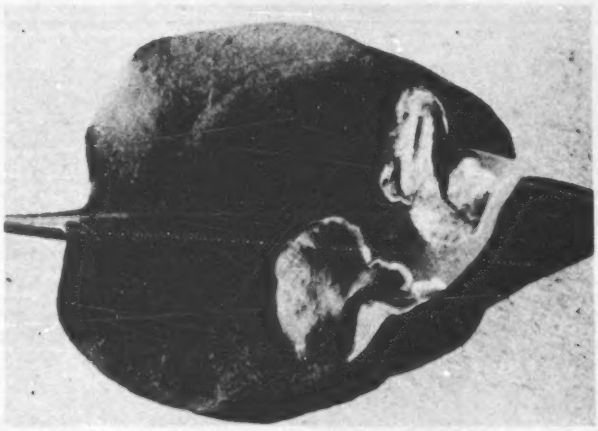

Figure 27. Lilac leaf miner

Figure 28. Leaf roller

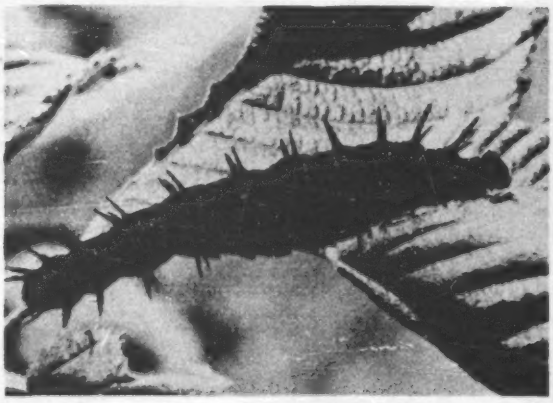

Figure 29. Mourning-Cloak butterfly larva
(Spring elm caterpillar)

opening buds, blossoms, young fruit, and unfolding leaves which they web together with silk. Later several leaves may be webbed together, forming a nest in which the larvae live and from which they move out to feed. Pupation occurs in flimsy cocoons spun inside the nest or on the branches.

Control

Formula: A, B, or C. Specific chemical controls; see pp. 44-46.

k. Mourning-cloak Butterfly (Spring elm Caterpillar) (Figure 29.)

The larvae of the mourning-cloak butterfly feed on elm, willow, poplar, and hackberry. Full-grown larvae are purplish-black with a scattering of white and red dots on its abdominal segments. The head is covered with tubercles and the body is covered with many large, branched spines. The butterfly is black-bodied and has a wing spread of 60-80 mm. The upper wing surface is dark reddish-brown except for a broad creamy-yellow border which contains a row of blue spots.

The adults overwinter and appear in early spring to deposit the egg clusters around small twigs.

Control

Formula: A, B, C, J, or L. Specific chemical controls; see pp. 44-46.

l. Pearslug and Cherryslug (Sawflies) (Figure 30.)

The tadpole-shaped slug-like larvae of the pearslug are pests of cotoneaster, cherry, pear, plum, and apple. The adult sawfly lays eggs beneath the epidermal layer; when they hatch, the young larvae begin feeding on the upper surface of the leaves. The full grown larvae are about 12 mm long and the body is covered with a shiny, olive-green, slime-like material which gives them the slug-like appearance. Heavily infested trees or shrubs appear as if scorched and may be severely injured. Full grown larvae drop to the ground and form cells in the soil in which they pupate. The adult sawfly, a black shiny insect with transparent wings may be observed on the leaves during June and July.

Control

Formula: B, or C. Specific chemical controls; see pp. 44-46.

m. Spruce Needle Miner (Figure 31.)

Spruce needle miner larvae mine needles of most ornamental varieties of spruce in Wyoming. Groups of dead, mined needles, which have a small hole near each needle base, are found webbed together on the twigs. Nests of needles are usually inconspicuous and commonly found on lower branches near the trunk.

Adult moths emerge in June to lay eggs on the needles. Larvae emerge in late June and feed until frost. They over-

Figure 30. Pearslug larvae

Figure 31. Spruce needle miner

Figure 32. Forest tent caterpillar

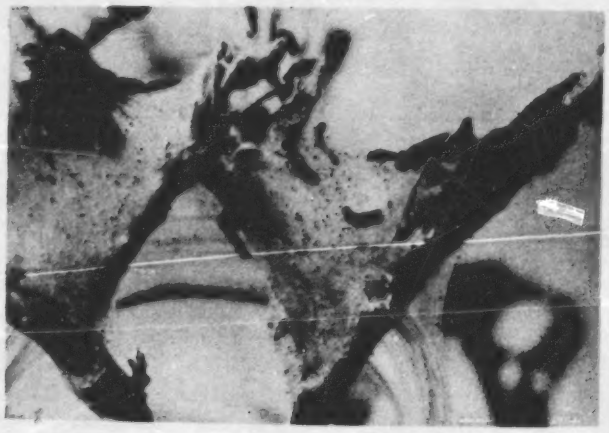

Figure 33. Tent caterpillar

winter in the nests and resume feeding in early spring. Pupation occurs in May.

Control

Formula: B or C. Specific chemical controls; see pp. 44-46.

n. Forest Tent Caterpillar (Figures 32 & 33.)

Bluish caterpillars, (to 2 inches long) marked with keyhole shaped white spots, strip leaves from poplar, birch, sugar maple, oak, and other deciduous trees and shrubs.

Commonly hatching when leaf buds burst, caterpillars may cluster on tree trunks or buildings during the 5-6 weeks feeding period. Cocoons are spun in crevices or between leaves. Moths emerge in June-July to lay brown shiny-appearing egg masses encircling twigs.

Control

Apply a spray as soon as feeding is noticed.

Formula: A, B, C, or G. Specific chemical controls; see pp. 44-46

3. Gall Producers

a. Ash Flower-Gall Mite (Figure 34.)

Male or staminate flowers of some ash trees become distorted and enlarged; unsightly masses form on twigs when infested with a minute gall-forming mite. These galls become blackened and remain on trees throughout the winter. Trees are not killed by this pest.

Ash trees have either male or female flowers. Planting only ash trees with female flowers will avoid the problem. Male blossoms appear before leaf buds open and mites infest them. It is possible that full-strength dormant spray on male blossoms before leaf buds open would kill mites before they have a chance to work.

Control

Apply a spray as soon as the tree is in bloom.

Formula: B, E, L, T, or M. Specific chemical controls; see pp. 44-46.

b. Chokecherry Midge Gall (Figure 35.)

The chokecherry gall is caused by an extremely small fly-like midge which infests developing fruit of the chokecherry. The eggs are apparently laid beneath the skin of the fruit, the larva hatches from the egg, burrows into the pit area, and feeds upon the developing pit. The small orange colored larva causes the fruit to be greatly enlarged over the normal fruit.

Control

The chokecherry can be protected by an application of

a recommended insecticide during the blossom period and a second application approximately 7-10 days later.

Apply a spray about the time the blossom period is over; repeat treatment in 10 days.
Formula: C or J. Specific chemical controls; see pp. 44-46.

c. Cottonwood Bud or Twig Gall Mite (Figure 36.)

The cottonwood bud or twig gall can easily be seen during the winter when the trees have no leaves. The galls are produced by a stimulation to the tree by tiny mites too small to be seen with the naked eye. The galls appear as woody warts or bumps on the twigs. The galls are caused by an eriophyid mite which is shaped like a cigar or perhaps a banana. They live within the galls. Gall growth starts when the mites feed on the leaf buds as they are breaking in the spring. Certain chemicals produced by the feeding mites cause the living plant tissue to develop galls.

Control

The simplest control method on isolated plants is to remove and destroy the galls when they are first discovered. Prune out the gall if possible and burn it.

Apply a spray at the time the buds are opening and repeat in approximately 14 days.
Formula: B. Specific chemical controls; see pp. 44-46.

d. Elm Cockscomb Gall Aphid

Cockscomb galls are raised malformations on upper-leaf surfaces of elm leaves which resemble a cock's comb, but their injury is considered insignificant. Aphids hatch from overwintering eggs laid on elm trees and begin to feed as soon as new leaves appear in spring. These aphids cause gall formations which are noticed first in May or June. Aphids feed inside the galls. The first three of six generations annually are spent on elms and the last three on grasses. Other aphids may produce pouch or sac-like galls similar to the cockscomb gall.

Control

Both larvae and adults of lady beetles and other natural enemies tend to reduce aphid populations.
Formula: A, C, E, I, J, or L. Specific chemical controls; see pp. 44-46.

e. Hackberry Nipple Gall Psyllid (Figure 37.)

The hackberry nipple gall psyllid causes a nipple-shaped growth on the underside of hackberry leaves. Psyllid insects suck plant sap and are often called jumping plant lice. Those which affect leaves emerge as 1/10 inch long adults from galls in fall and overwinter as adults in protected places on the trees. In spring, after mating, eggs

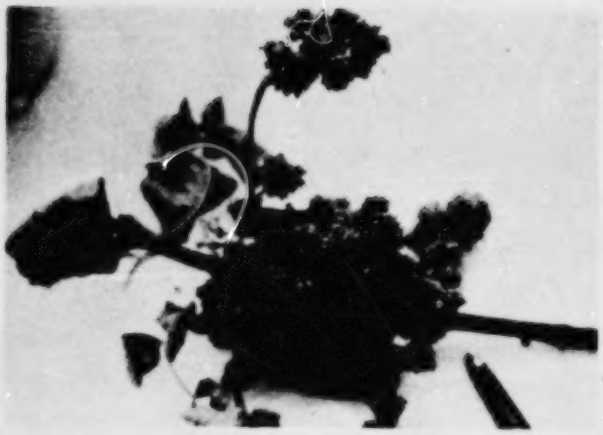

Figure 34. Ash flower mite gall

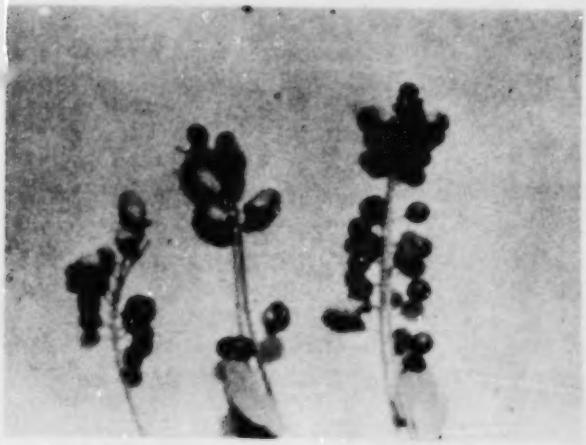

Figure 35. Chokecherry midge gall

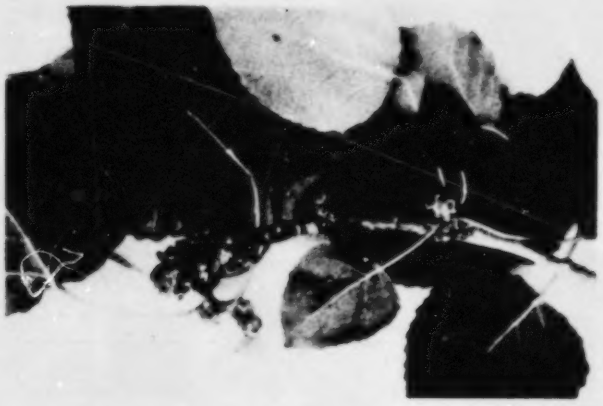

Figure 36. Cottonwood bud mite gall

Figure 37. Hackberry nipple gall

Figure 38. Honey locust pod gall

are laid on undersides of leaves. Newly hatched nipple psyllid nymphs feed on undersides of leaves, where the gall surrounds them; blister psyllid nymphs crawl to upper leaf surfaces to feed and soon thereafter are enveloped by galls.

Control

Damage to trees is negligible, but adults often are a problem when buildings are being painted. They also cause problems when large numbers of the tiny adults enter buildings through screened windows. Psyllids are protected while they are inside galls.

Apply a spray in the spring when the leaves are forming and repeat the treatment in 7-10 days.

Formula: A, C, I, or J. Specific chemical controls; see pp.44-46.

f. Honey Locust Pod Gall (Figure 38.)

Pod-shaped galls, 1/4 inch in diameter, are produced by this midge on the terminal leaflets. Thornless varieties of locust such as Moraine are particularly susceptible. Gall covered leaflets may dry up and be shed prematurely, especially when they have been attacked several times. Trees are rarely ruined by an infestation, but unsightliness is another matter and may be dealt with as the situation requires.

The adult midges appear in May at about the time locusts start growth. These midges are about 1/8 inch long. The males are black and the females have a red abdomen. The tiny kidney shaped eggs are inserted singly or in clusters among the leaflets. The larvae hatch in 1 or 2 days and start feeding. Larval feeding on the inner surface of a leaflet stops its development but the outer surface grows normally. This produces the pod from which the insect gets its common name. When feeding is completed the adults emerge. There are two or three generations each year.

Control - May not be practical.

No insecticide approved.

g. Leaf Stem Gall Aphid (Figure 39.)

The leaf stem gall is caused by an aphid. It is common on cottonwood and poplar. This is an oval gall on the petiole (leaf stem) near the leaf base. Close inspection of the gall reveals a slit in the side of the gall through which the aphids emerge when mature.

Control

Apply a spray when the leaves are forming in the spring and repeat in 10-14 days.

Formula: A, J, or T. Specific chemical controls; see pp. 44-46.

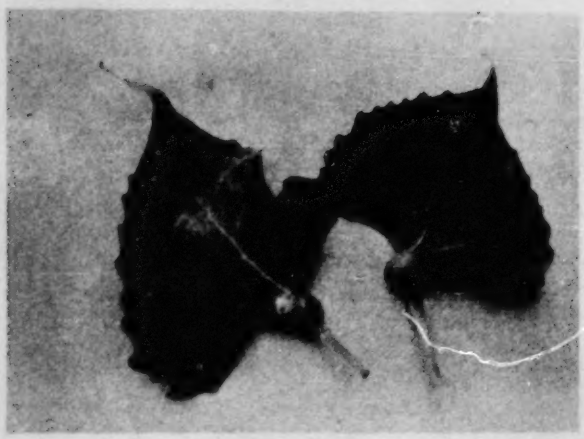

Figure 39. Cottonwood leaf stem gall

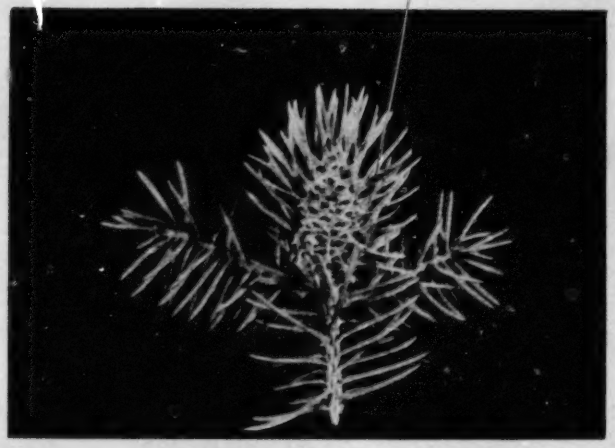

Figure 40. Cooley spruce aphid gall

Figure 41. Vagabond aphid gall

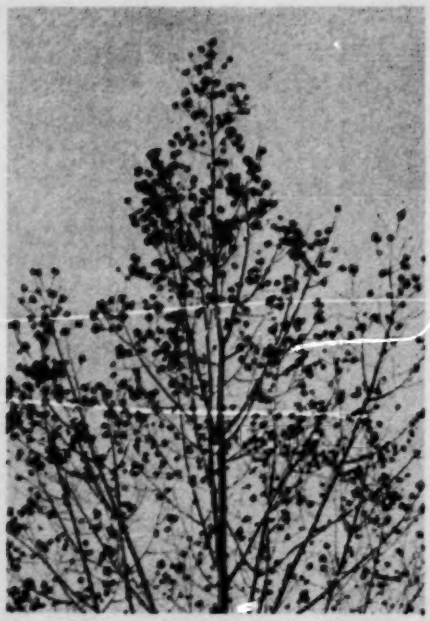

Figure 42. Vagabond galls as they appear during winter.

h. Cooley Spruce Gall Aphid (Figure 40.)

Pineapple-shaped deformations or galls 1/2-1 inch long at the tips of spruce twigs are caused by this aphid's feeding. (A closely related species, the Eastern spruce gall aphid, causes a deformation at the bases of the twigs.) Trees may not die as a result, but many needles and twigs are killed.

Aphids feed in spring at the bases of new shoots and galls form over them. These galls open in late summer, and winged females emerge to lay eggs which hatch in about 2 weeks. Overwintering aphids attach themselves to the bases of buds.

Control

For light infestations, good control may be obtained by picking and destroying green galls in June before they have released the aphids.

Apply a spray at the time the spruce tree is showing new growth in the spring and then repeat the treatment in 10-14 days.

Formula: A, B, C, I, J, or L. Specific chemical controls; see pp. 44-46.

i. Cottonwood Vagabond Gall Aphid (Figure 41 & 42.)

Cottonwood vagabond galls are caused by an aphid. The galls remain on the tree the year-round and several years' accumulations of galls on a tree makes it stand out conspicuously. The aphids pass the winter as eggs in the old galls on the trees. The eggs hatch in the spring and new aphids make their way to the growing shoots where their feeding causes new hollow galls to be formed. The aphids mature in the gall. The galls are green at first, but turn brown and then black by mid August. During August, the winged forms emerge and fly to alternate hosts. In the fall these winged forms return to the galls from which they migrated in the summer. A second generation is produced, which lays eggs inside the galls. This habit of returning to the same tree each year heavily infests trees with galls while other nearby poplars remain uninfested.

Control

Apply a spray at the time the leaves are starting to form; repeat the treatment in 10-14 days.

Formula: A, I or J or L. Specific chemical controls; see pp. 44-46.

4. Borers

a. Pine Bark Beetle (Figure 43.)

The mountain pine beetle is one of the most destructive forest insects affecting Wyoming lodgepole and ponderosa pine. The first evidence of attack are pitch tubes on the tree trunk, marking places where beetles have entered. Pitch tubes are dark red to cream colored masses of resin mixed with bark and

wood borings. After trees have been attacked, they start to fade a month to a year afterwards depending on the season and weather. The needles change from green to yellowish-green and finally rusty brown before dropping off.

Adult beetles attack by boring through the bark to the cambium area, then tunnelling upward along the inner bark. The females lay eggs in these galleries that are roughly 12-30 inches long. After hatching, the larvae feed on the inner bark in individual channels, which extend generally at right angles to the egg galleries. When fully developed, pupation takes place at the end of the larval gallery. Adults eventually emerge and fly to attack new trees and start a new generation. The adults are cylindrical, stout-bodied insects, from 1/8 to 3/8 inches long, usually a reddish-brown to black.

Control

Formula: H or I. Specific chemical controls; see pp. 44-46.

b. Elm Bark Beetle

The smaller European elm bark beetle, which carries Dutch Elm Disease, is known to occur on elm in Wyoming.

.The European elm bark beetle, approximately 1/8 inch long, shiny, and dark reddish brown, is the main carrier. The underside of the hind quarters of its body is concave with a noticeable projection or spine. Adults of the native species are also about 1/8 inch long, but they are dull brown and do not have the concave or spine characteristics.

Larvae of both the Pine Bark and European Elm Bark beetle are similar - white, footless grubs about 1/8 inch long when full grown. The beetles prefer recently cut, broken, weakened, or dying trees for laying eggs. Eggs of the European species are laid in straight galleries which follow the grain of the wood. The native species lay eggs in galleries which cross the grain.

Beetles overwinter as larvae under the bark of trees or logs. In the spring larvae complete their growth, pupate, and change into adult beetles. The beetles begin to emerge about the middle of May through holes they make in the bark. In Wyoming there is probably a second brood which emerges in late July or early August.

The adult flies a short distance, usually not more than 500 ft., where it feeds on the bark of small branches of living elms. If the beetle emerged from a diseased tree, it can carry fungus spores to the feeding wounds it makes on healthy trees, unless a thorough application of insecticide kills the beetle.

After feeding on healthy trees, adults seek breeding sites under the bark of dead or weakened trees and logs. They bore through the bark and into the cambium area where they lay their eggs.

Control

The only known method of Dutch elm disease control is to prevent the fungus from moving through the root grafts and to keep the bark beetles from carrying the fungus from diseased to healthy trees. There is no known cure for the disease once it is established within an elm. Three things are important: (1) Sanitation, (2) destruction of root grafts, and (3) control with insecticide.

Since we do have a special bulletin on the subject, for further details, please obtain a copy of the University of Wyoming Bulletin No. 515, "Dutch Elm Disease In Wyoming."

The insecticides can be applied two ways. One -- the insecticide is applied in large quantities of water with a hydraulic power sprayer, and the other way -- the insecticide is applied in small quantities of water by the use of a mist blower.

Insecticide applications should be made in early spring. If necessary, make a second application during early July.

Formula: K. Specific chemical controls; see pp. 44-46.

c. Lilac Borer (Figure 45.)

This borer is a pest of lilac, ash, and occasionally privet and mountain ash. Plants affected appear unthrifty with wilting or dying shoots. The surest symptom is the presence of borer holes in rough, cankerlike areas on older stem bases often near graft scars. Dark moist sawdust oozing from these holes indicates active feeding.

Eggs are laid in May or June on rough basal bark or near scars and wounds. The larvae bore into the stems throughout the summer and fall and overwinter in this stage. These borers are cream colored, 3/4-1 inch long, brown headed, and have a yellow band on the last body segment.

Control

Lilac borers are difficult to control once they are beneath the bark. There is no magic formula that can be applied to the soil or shrub to kill wood borers. Preventing the borer from infesting the shrub is the best. Weakened shrubs are especially susceptible. Shrubs in vigorous condition are less subject to attack. Prune infested, dead or dying branches. Clean and paint all wounds.

Apply insecticide late in May to early June at 3 week

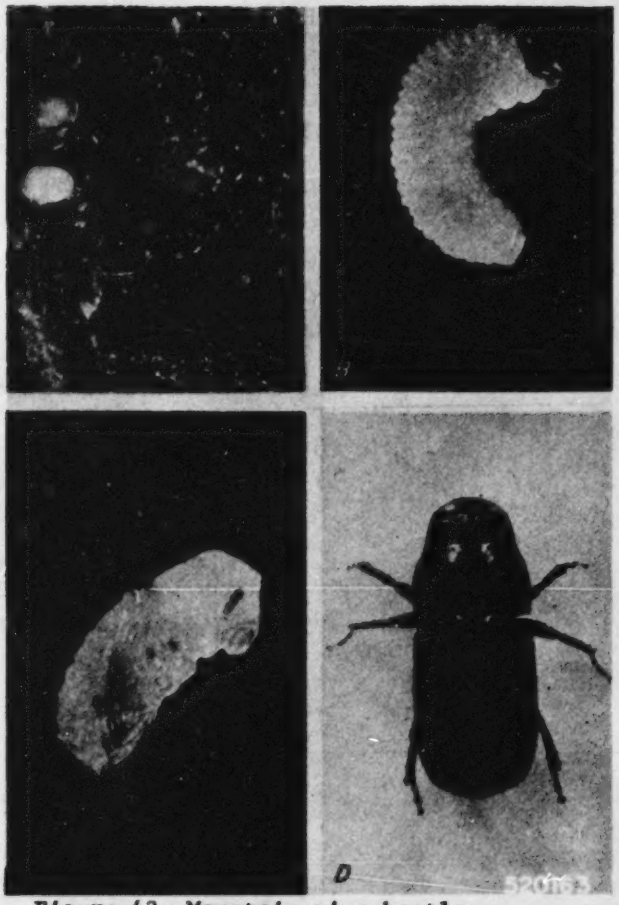

Figure 43. Mountain pine beetle
A. eggs, B. larva, C. pupa, D. adult
(U.S.D.A. Photograph)

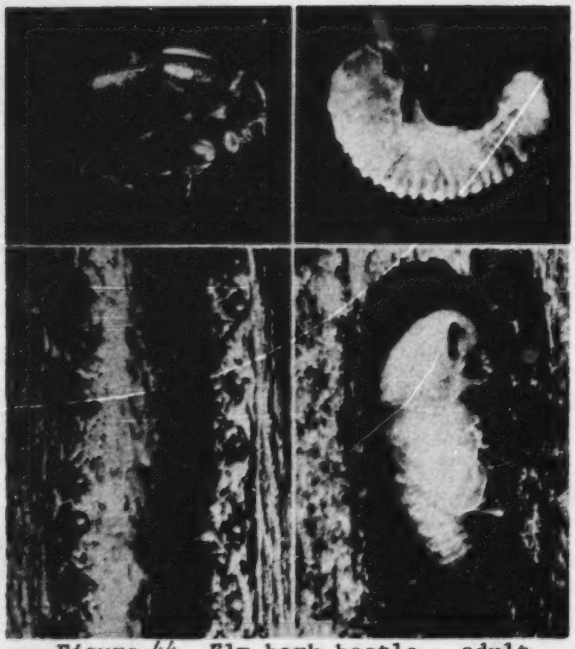

Figure 44. Elm bark beetle - adult, larva, eggs, and pupa

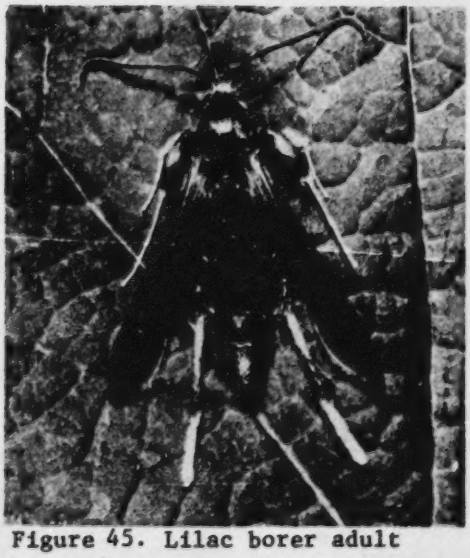

Figure 45. Lilac borer adult

intervals. Thorough stem coverage is essential.

Formula: H, I or T. Specific chemical controls; see pp. 44-46.

d. Locust Borer (Figure 46.)

Black locust and roseacacia locust become stunted, disfigured, or broken-over due to tunnelings of whitish borers. Symptoms include swollen trunk areas with scarred, gnarled bark, broken limbs, wet bark areas in fall and spring, and summer accumulations of sawdust along the base of the trunk.

Borers pupate in late summer; black beetles 3/4 to 1 inch long with zig-zag golden-yellow markings emerge in early September to lay eggs in bark crevices. Small larvae soon hatch and bore into inner bark to overwinter.

Control

Locust borers are difficult to control once they are beneath the bark. There is no magic formula that can be applied to the soil or tree to kill wood borers. Preventing the borer from infesting the tree is the best. Weakened trees are especially susceptible. Trees in vigorous condition are less subject to attack. Prune infested, dead or dying branches. Clean and paint all wounds.

Apply insecticide treatment early in August and repeat in 3 weeks.

Formula: I. Specific chemical controls; see pp. 44-46.

e. The Horntails (Figure 47.)

Horntails invade only dead or weakened trees. They will not attack healthy trees; however, they will attack dead areas of a living tree. The preferred hosts are the American elm, Siberian elm and boxelder. Females are attracted to injured trees or trees weakened by fire.

During early summer, the adult wasps emerge from circular holes that have the appearance of a .22 caliber bullet hole.

The adult horntails are sturdy, wasp-like insects from 1/2 to 2 1/4 inches in length. They are usually black or metallic blue and often have markings of yellow, red, or brown. Horntails have four clear wings. The female has a sturdy, horn-like ovipositor, but the male abdomen ends in a small, sharp point. The insect will not bite or sting.

Control

Horntails are difficult to control once they are beneath the bark. There is no magic formula that can be applied to the soil or tree to kill wood borers. Preventing the borer from infesting the tree is best. Weakened trees are especially susceptible. Trees in vigorous condition are less subject

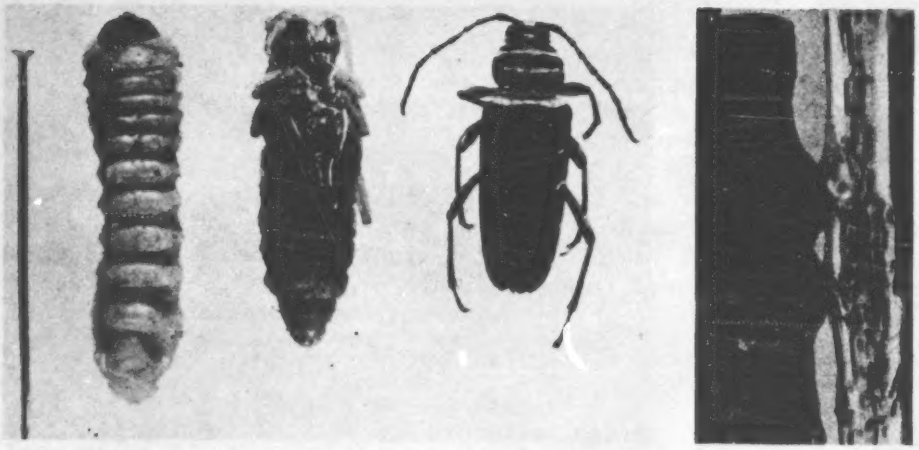

Figure 46. Locust borer, left to right larva, pupa, adult and damage (U.S.D.A. Photograph)

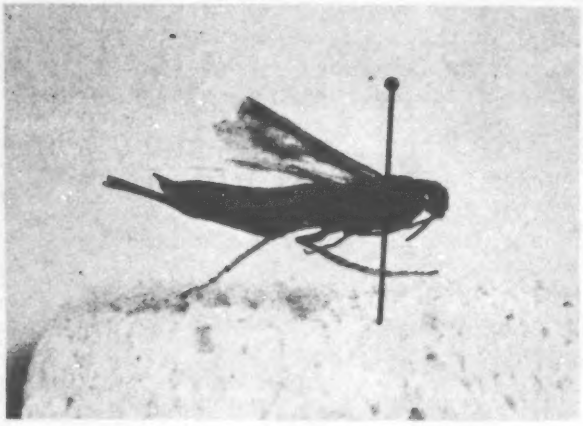

Figure 47. Horntail adult

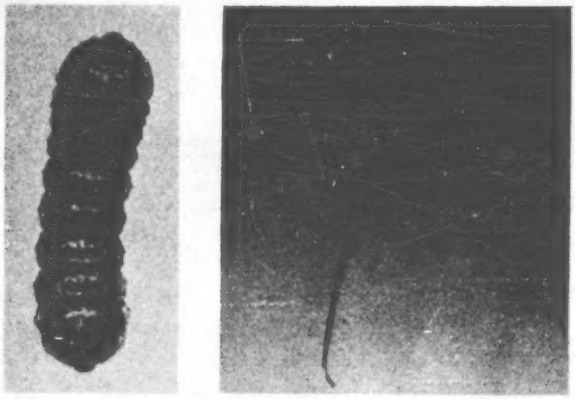

Figure 48. Poplar borer larva and adult (Larva is U.S.D.A. Photograph)

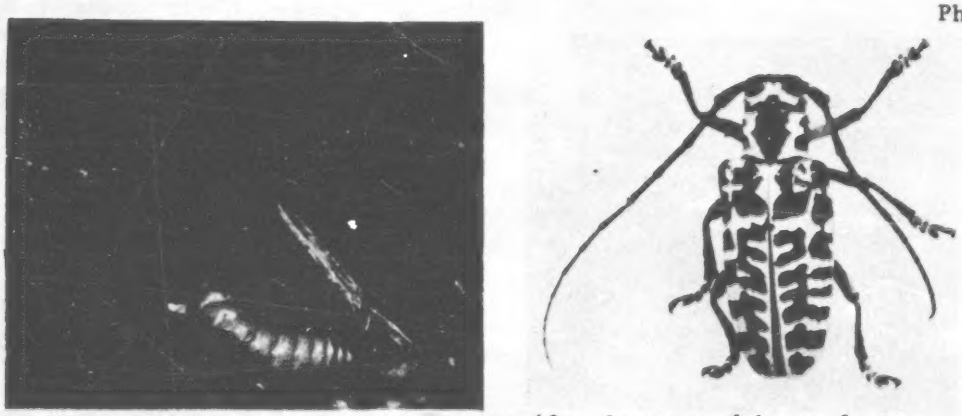

Figure 49. Cottonwood borer larva and adult (U.S.D.A. Photograph)

to attack. Prune infested, dead or dying branches. Clean and paint all wounds.

Treatment is seldom, if ever, justified.

f. Poplar Borer (Figures 48 & 49.)

The adults are long-horned, 1 1/4 inch beetles with tiny black and yellowish spots on their gray bodies. They feed on the bark of young twigs, and the female deposits eggs in crevices in the bark. After hatching, the larvae burrow into the bark and spend their first year working just beneath it. During the second year they tunnel further into the trees and attain a length of about 2 inches. It may take 3 years to complete the life cycle. The tunnel openings show a wet sawdust-like frass and often sap will ooze from the wound openings. Trees or larger limbs may be weakened at the point of attack so much that they become subject to wind damage.

Control

Poplar Borers are difficult to control once they are beneath the bark. There is no magic formula that can be applied to the soil or tree to kill wood borers. Preventing the borer from infesting the tree is the best. Weakened trees are especially susceptible. Trees in vigorous condition are less subject to attack. Prune infested, dead or dying branches. Clean and paint all wounds.

Spray trunks and lower limbs thoroughly during early August and repeat in 3 weeks.

Formula: I or K. Specific chemical controls; see pp. 44-46.

5. Lawn Insects and Pests

a. Bluegrass Billbug

Bluegrass billbugs are not common in Wyoming, but have been found in Torrington and Rock Springs.

The worm or larva, 1/4 to 3/8 inch long, resembles a small white grub, except they are legless and have a distinct brown head.

The adult, a small beetle, is either black or brown and is often called a snout beetle due to the distinct snout or "bill" at the front of the head. Billbugs have wings but are poor fliers. They are probably introduced into new areas in nursery stock.

The beetles overwinter as adults and become active in May. Eggs are laid in grass stems from late May to July. After hatching, the grubs feed on stems, then move to soil to feed on crowns and roots during July and August. After feeding, the larvae, or grubs, change to a quiet resting stage in the

soil, later emerge as beetles in August and September. They hibernate in turf, litter, under bushes and in other protected places.

The damage to the lawns is caused by the grubs chewing off roots just below the ground. The sod then becomes dry, yellowed and loose. Adults rip and shred the grass stems. Damage may occur in small spots and may cover a large area. Small damaged areas usually recover when grubs are controlled, but large areas may need to be resodded.

Control

Effective control may be achieved by treating with diazinon. The applicaiton should be timed to control the adults to prevent egg laying during late May and June.

Formula: C. Specific chemical controls; see pp. 44-46.

b. Clover Mites (Figure 50.)

Clover mites are frequently household pests. They are eight-legged, red or brown animals, smaller than a pin head. They do not bite people, pets, feed on household furnishings, kitchen supplies, or clothing. They are just nuisances. The only damage that might occur is spots on walls, furnishings, or cloth if the mites are crushed.

Clover mites feed on clovers, grasses, and other plants in lawns, or ornamental plantings near homes. Reproduction is continuous during spring, summer, and early fall. Although they may be present in large numbers, plants are rarely severely injured. New lawns, or well maintained and fertilized older lawns favor development.

In the fall mites move to vegetation around buildings, especially warm (west and south) sides. They invade homes by the thousands by crawling through cracks around windows, doors, or other openings. They gather in large numbers on sides of homes. The fall invasion usually begins with the first cold days. Hundreds of mites may hibernate behind window frames, undersiding, or in bricks. They continue to be pests during warm days of winter.

In the spring they again become active with the first warm days, moving from the walls into homes from hibernating places. They actually are trying to find the yard again for summer picnics, but their direction finding mechanism is not highly effective.

Control

Fall invasions can be reduced by spraying the exterior walls, foundation, and 15 to 20 ft. into the lawn. Fall sprays should be used before mites begin to move in numbers - about mid to late September.

Spring infestations can be reduced by spraying. It is necessary to spray thoroughly, forcing spray behind window frames, into cracks, and other external openings.

An area 24 inches wide, free of grass, around homes will discourage mites moving to homes. This area can be planted to some heat-hardy flowering plants such as chrysanthemums, zinneas, marigolds, and some bulb plants.

Formula: C, J, N, O, or P. Specific chemical controls; see 44-6. Separate bulletin #635 is also available.

c. Earthworms (Night Crawlers)

Control

Chlordane has been the only insecticide approved for this use. At the time of the writing of this information, one could use chlordane available on the market. Whenever the supply is exhausted, there will be no effective insecticide for earthworm control. Some other insecticides will kill earthworms, but they lack the residual of chlordane so the earthworms are able to move back into the treated area in a short time.

d. Sod Webworm (Figures 51 & 52.)

The sod webworm is one of the more destructive insect pests of the bluegrass. Most of the problem in Wyoming has been in the northwest.

The first signs of sod webworm damage are areas of unevenly cropped grass. The damage usually becomes more serious in the summer when hot-dry conditions are present.

The sod webworm are about 3/4 inch long and light brown. Their bodies are covered with fine hairs. The adults are about 3/4 inch long, cigar shaped, and whitish to gray moths. Two small finger-like projections are visible at the front of the head. When at rest, the wings are wrapped around the body to form a half circle. They hide in shrubbery or grass during the day. In the evening the moths are flying about laying their eggs at random in the grass. The sod webworm spend the winter as a partially grown larva several inches deep in the soil. At the approach of spring, the larvae move up and feed on the new growth of grass. As the larvae grow, they build burrows or tunnels on the soil surface among the thatch of grass. They cut off grass blades, drag them into their tunnels, and eat them. The sod webworm feeds only at night, remaining in the silken tunnels during the day.

Control

Very close observations should be made in order to detect whether sod webworms are causing the damage. The

larvae can be found by breaking apart some of the drying sod. If there are three to four larvae within a 6 inch square section, an insecticide treatment is recommended. Another method of determining whether sod webworms are present, is the use of pyrethrum as a flush. Use a tablespoon or two of 1% pyrethrum emulsifiable concentrate to a gallon or two of water and sprinkle on one square yard of turf. Usually, this will cause the worms to squirm to the surface within 10 minutes.

Formula: B or C. Specific chemical controls; see pp. 44-46.

e. White Grubs or June Beetles (Figures 53 & 54.)

Grubs are the larvae of the June or May beetles. The grubs are white with brown heads and six prominent legs. The hind part of the body is smooth and shiny, with dark body contents showing through the skin. The grubs have curved bodies, from 1/2 to over 1 inch in length. They feed on roots of various plants.

The adult beetles eat the leaves of ash, poplar, elm, willow, locust, hackberry, and other trees. They also feed on herbacious plants, particularly weeds.

The winter is passed in the soil in both the grub and adult stages. In the spring after the trees have put forth leaves, the adults become active, fly about during the night, mating and feeding. At the first streaks of dawn, they return to the soil, where the females lay their pearly white eggs from one to several inches below the surface. While the beetles may be moving at dusk from the soil to the trees for an hour or more, the return to the soil at dawn takes place very rapidly. The eggs are generally laid in grass lands, or patches of grassy weeds in cultivated fields. They hatch in 2 or 3 weeks, and the young grubs feed on the roots and underground parts of plants until early fall, when they are about 1/2 inch long. They then work their way down in the soil usually below the frost line, and have been found 5 ft. below the surface.

As the soil warms in the spring, they work upward and, by the time plant growth is well started, they are feeding a few inches below the surface. Feeding continues throughout the season.

Control

Formula: C, G, or T. Specific chemical controls; see pp. 44-6.

f. Spider (Figure 55.)

Spiders are familiar to almost everyone. All have eight legs which immediately separate them from insects which have only six. Spiders have two body regions; they lack wings and antennae. Insects, on the other hand, have

three body regions. Young spiders resemble adults except for size.

About 1,000 species of spiders are found in this country. They live almost everywhere, including inside homes and other buildings. For the most part they are beneficial to man. Spiders feed entirely upon living insects and related organisms such as centipedes. They usually lie in wait for their prey, and many build webs to trap flies and other insects.

Webs are made of fine silken threads produced by "spinning glands" located near the end of the spider's abdomen. The silk is secreted in liquid form and hardens when exposed to air. Spiders use the silk not only to make webs, but also to line nests, construct egg sacs, and to make parachutes on which some species travel for long distances.

Spiders reproduce by laying eggs in an egg sac. These sacs are usually ball-shaped and may be carried by the female wherever she goes. Some species hide their sacs in the web or tuck them away elsewhere. Each egg sac may contain several hundred eggs.

Some people think that all spiders are poisonous or dangerous to handle. This is not true. Only two kinds of spiders found in the United States are capable of inflicting serious injury to humans. These are black widow spiders and the brown recluse spider and its relatives. The black widow spider is found in Wyoming, but the brown recluse (fiddleback or violin spider) is not known to be established in the State.

The black widow spider's body is about 1/2 inch long and shiny jet black on the upper surface. Females are marked with a reddish or yellowish "hour glass" on the underside of the abdomen. Persons bitten by one of these spiders experience severe pain in just a few minutes; therefore, a physician should be called at once.

The brown recluse spider's body is about 1/2 inch long; the abdomen is light brown and the head area has a darker brown, fiddle-shaped marking. Bites by this spider are rare and can vary from a mild to a severe reaction. The person bitten may not be aware of it for one to several hours. A stinging sensation is usually followed by intense pain. Small blisters usually arise and a large area around the bite becomes swollen. In the case of a bite by this spider, a physician also should be consulted immediately.

The brown recluse spider reportedly has been seen in most parts of Arkansas, Oklahoma, Kansas, Texas, Mississippi, and Tennessee. It also has been found in surrounding states.

Control

Residual sprays are the most effective materials for controlling spiders outside of the home. Since spider infestations often originate in basements and unexcavated areas beneath the house, you can obtain more complete control by thoroughly treating these areas in the spring with a residual spray. Such treatment will lessen chances of spiders migrating into living quarters.

For control outside the home, treat under eaves, porches, piles of bricks, stones, lumber or wherever spiders are found. Use a water-base spray outdoors since oil-base sprays injure plants.

For use in living quarters of the home, your best buy is a ready-to-use spray. Do not apply oil base sprays to asphalt tile; take care to keep the spray away from fire, such as pilot lights and sparks from electrical equipment which might ignite the oil.

Spider webs should be removed with a vacuum sweeper or brushed down with a rolled newspaper and burned. Ordinary house cleaning with a cloth or dust mop does little to destroy spiders.

Obtain a copy of University of Wyoming Bulletin #537, "Spider Control."

Figure 50. Clover Mite

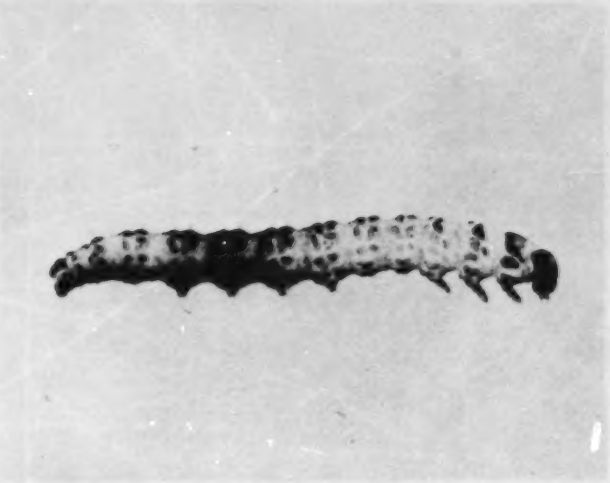

Figure 51. Sod webworm larva
(U.S.D.A. Photograph)

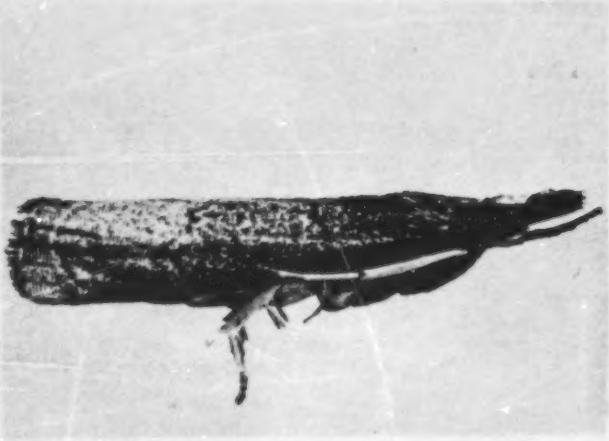

Figure 52. Sod webworm adult
(U.S.D.A. Photograph)

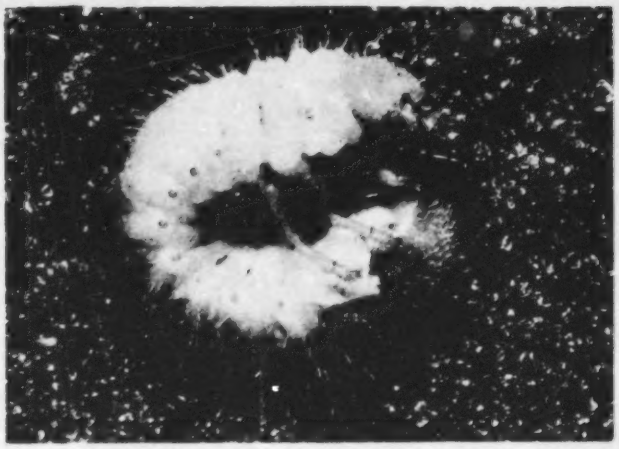

Figure 53. White grub larva
(Texas A & M Photograph)

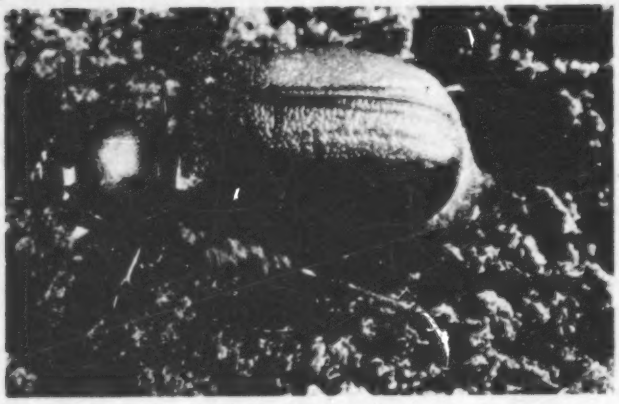

Figure 54. White grub adult
(Texas A & M Photograph)

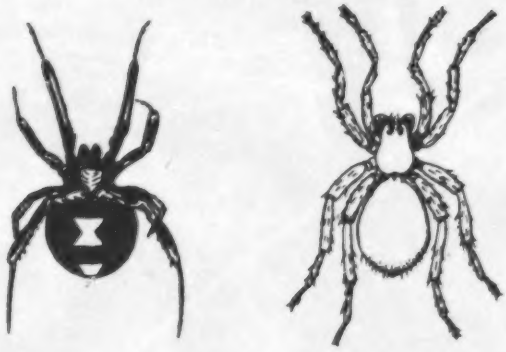

Figure 55. Spiders

Insecticide Recommended for the Tree, Shrub and Lawns *(Nonfood Use)*

Select one of the formulas suggested for the pest. Make sure you read the container label to learn on what plants the product can be used, and for what pests it is approved. If the formulation you have purchased differs from that listed, follow directions on the container.

All measures given are for 1 or 100 gallons of mixture, unless otherwise stated.

Formula A. General purpose Sprays

"All purpose" insecticide spray or dust mixtures are readily available. They will control a number of pests but are not always the best for a specific problem. Some people may not want to be bothered with purchasing a half dozen different kinds of insecticides. They are willing to take their chances on the results. Those that may be available and may be used on a variety of plants may contain?

a. Carbaryl (Sevin) plus malathion.
b. Methoxychlor plus malathion.
c. Carbaryl (Sevin), Meta-Systox R (systemic insecticide), Kelthane (miticide) and often a fungicide.
d. Carbaryl (Sevin), malathion and Kelthane.

Before you purchase an "all purpose" mixture, make sure you read the label to learn on what plants the mixture can be used. Follow label directions.

		Amount to mix per 1 gal	100
Formula B.	Carbaryl (Sevin)		
	a. 80% WP	4 tsp	1¼ lb.
	b. 4 lb Flowable	1 Tbsp	1 qt
	c. Sevimol (4 lb/gal EC)	2 tsp	1 qt
	d. 27% Liquid	1 Tbsp	1 pt/32 gal
	e. 50% WP	2 Tbsp	2 lb.
Formula C.	Diazinon		
	a. 25% EC	2 tsp	2 pt
	b. 48-50% EC	½ fl oz	
	c. 50% WP	1 Tbsp	3 gal
	For Lawn areas only:		
	d. 2% G	6 lb/1000 sq ft	

		Amount to mix per 1 gal	100
	e. 14 G	1 lb/1000 sq ft	
	f. 5% G	2½ lb/1000 sq ft	
	g. 25% EC	8 oz/3gal/1000 sq ft	
Formula D.	Dimethoate (Cygon, Defend)		
	a. 23.4% EC	2 tsp	
Formula E.	Demeton (Systox) - For professional applicator use only		
	a. 68% EC	1 tsp	1 pt
Formula F.	Disulfoton (Di Syston)		
	a. 2% G	Follow label directions	
Formula G.	Trichlorfon (Dylox)		
	a. 80% SP	1¼ Tbsp	1¼ lb.
	b. 50% WP	4-6 oz/30 gal/1000 sq ft of lawn	
Formula H.	Endosulfan (Thiodan)		
	a. 2 lb/gal EC	2 tsp	2 pt
	b. 50% WP	2 Tbsp	2 lb.
Formula I.	Lindane		
	a. 20% EC	2 Tbsp	2 qt
	b. 20% oil solution	1 gal in 15 gal of No. 2 fuel oil - wet bark	
	c. 25% WP	1 Tbsp	1 lb.
	d. 2% dust	follow label directions	
Formula J.	Malathion		
	a. 50-57% EC	3 tsp	3 pt
	b. 5% dust	follow label directions	
Formula K.	Methoxychlor		
	a. 50% WP	2-3 Tbsp	2-3 lb.
	b. 5% D	follow label directions	
	c. 25% EC	2 Tbsp	2 qt
		For elm bark beetle only -- 8 gal in hydralic sprayer before April 25. or 40 gal in a mist blower.	
Formula L.	Meta-Systox-R		
	a. 25% EC	1½ tsp	1½ pt
Formula M.	Zectran - may not be available		
Formula N.	Chorebenzilate		
	a. 25% EC	1 Tbsp	1 qt

		Amount to mix per 1 gal	100
Formula O.	Dicofol (Kelthane)		
	a. 18.5% WP	2 Tbsp	2 lb.
	b. 18.5% EC	1 Tbsp	1 qt
	c. 35% WP	1 Tbsp	1 lb.
Formula P.	Tetradifon (Tedion)		
	a. 25% WP	1 Tbsp	1 lb.
Formula Q.	Mesurol		
	a. Follow label directions		
Formula R.	Metaldehyde		
	a. Follow label directions		
Formula S.	Imidan		
	a. 50 WP	1-1½ Tbsp	1-1½ lb.
Formula T.	Dursban		
	a. 2 lb/gal EC	1 tsp	1 pt
	b. 2 lb. (For sod webworm)	1½ fl oz/30gal/1000 sq ft	
Formula U.	Orthene		
	a. 75% SP	1 Tbsp	1 lb.

ABBREVIATIONS

tsp	= teaspoon	lb.	= pound
Tbsp	= tablespoon	oz	= ounce
pt	= pint	sq ft	= square feet
qt	= quart	fl	= fluid
gal	= gallon	WP	= wettable powder
G	= granular	EC	= emulsifiable concentrate
D	= dust	SP	= soluble powder

Flowable = liquid form

Sevimol = liquid molasses suspension of carbaryl (Sevin) - dispenses easily in water.